DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an image display device equipped with the cathode substrate which has electron emission equipment which performs field electron emission especially, and its manufacture approach about the image display device to which the anode plate substrate and cathode substrate of a pair are made to come to counter through a spacer, and its manufacture approach.
[0002]
[Description of the Prior Art] In recent years, the researches and developments about an image display device are promoted in the direction which thin-shape-izes a display. In such a situation, the field emission mold display unit (it is hereafter called FED (Field Emission Display) for short.) with which the so-called electron emission equipment was arranged can be mentioned as image-display-device equipment which is capturing especially the spotlight.
[0003] This FED has the cathode substrate which has electron emission equipment, and the anode plate substrate which has a fluorescent substance layer, countered the cathode substrate, and was arranged. Generally in this cathode substrate, the electron emission equipment of the Spindt mold or a flat-surface mold is formed as electron emission equipment. Moreover, the anode electrode with which the anode ** thickness for accelerating the electron emitted to the lower layer of a fluorescent substance layer from electron emission equipment is impressed to an anode plate substrate is formed.
[0004] And in this FED, between a cathode substrate and anode plate substrates is maintained in the vacuum ambient atmosphere. For this reason, atmospheric air will receive a big pressure to these cathode substrate and an anode plate substrate.
[0005] For this reason, in FED, a possibility of curvature having occurred or damaging further was in the cathode substrate and anode plate substrate which were arranged face to face with the big pressure. In order to avoid this, he thick-film-izes a cathode substrate and an anode plate substrate, and is trying to obtain predetermined reinforcement to a high pressure in FED. However, since it needs a glass substrate with a thickness of about 10mm in needing a glass substrate with a thickness of about 5mm concretely in manufacturing FED of 5 inches of vertical angles, and manufacturing FED of 10 inches of vertical angles, it will become what is hard to be called light and thin FED.
[0006] For this reason, for example, a cathode substrate and an anode plate substrate are produced using a thin glass substrate [as / whose thickness is 1.1mm], and it is possible to maintain the reinforcement to the big pressure by atmospheric air which arranged and mentioned the spacer above between these cathode substrate and the anode plate substrate with FED. it was formed of printing or a photolithography between the thing of the shape of a bead arranged at random between a cathode substrate and an anode plate substrate as this spacer, the thing of the shape of a cylinder arranged in the invalid pixel field between a cathode substrate and an anode plate substrate, the cathode substrate, and the anode plate substrate -- the thing of the shape of pillar-shaped or a wall can be illustrated.
[0007] However, when a bead-like spacer is used, the part in which the spacer of the shape of this bead exists will become an invalid field, and brightness will be reduced. If between a cathode substrate and

anode plate substrates is enlarged in order to raise the electrical strength between a cathode substrate and an anode plate substrate especially, since it is necessary to also enlarge a bead-like spacer, an invalid field will become larger. That is, in using the spacer of the shape of this bead, there is un-arranging [to which spacing between a cathode substrate and an anode plate substrate becomes large / that follow a thing and an invalid field becomes large].

[0008] Moreover, in arranging a cylinder-like spacer, in order to arrange two or more big spacers of an aspect ratio (height/diameter), it was difficult to obtain sufficient reinforcement to a big pressure.

[0009] Furthermore, in the case of the wall-like spacer, it was difficult pillar-shaped or to form such a spacer by printing or the photolithography between a cathode substrate and anode plate substrates (i.e., height of about 1-2mm).

[0010]

[Problem(s) to be Solved by the Invention] As mentioned above, it was difficult to form a spacer certainly [excel in the reinforcement to a big pressure, and], without reducing the brightness of a display image in the conventional FED. In order to solve such a problem, installing a tabular spacer is indicated by the United States patent number No. 564847. This tabular spacer forms a rail-like spacer guide in a cathode substrate and an anode plate substrate, and is arranged by inserting in these spacers guide.

[0011] Therefore, in order to arrange such a tabular spacer, it is necessary to form the big spacer guide of a width-of-face height ratio in a cathode substrate and an anode plate substrate with high precision. However, it was difficult to form the big spacer guide of such a width-of-face height ratio in a cathode substrate and an anode plate substrate with high precision. For this reason, there was a problem that a spacer could not be formed certainly easily, by the technique indicated by the United States patent number No. 564847.

[0012] Then, without solving the trouble of the conventional electron emission equipment mentioned above, and reducing the brightness of a display image, this invention is excellent in the reinforcement to a big pressure, and aims at offering the image display device which can form a spacer certainly, and its manufacture approach.

[0013]

[Means for Solving the Problem] The image display device concerning this invention which attained the purpose mentioned above The anode plate substrate with which it comes to form the image display section at least on the 1st substrate, The cathode substrate arranged so that it might come to form electron emission equipment at least on the 2nd substrate and the above-mentioned anode plate substrate might be countered, An abbreviation rectangle is presented and it has the spacer set up between the above-mentioned anode plate substrate and the above-mentioned cathode substrate. The above-mentioned spacer While fixing the both ends of the longitudinal direction to either [at least] the above-mentioned anode plate substrate or the above-mentioned cathode substrate, it is characterized by adding tension to the longitudinal direction of the spacer concerned.

[0014] In the image display device concerning this invention constituted as mentioned above, between an anode plate substrate and cathode substrates is maintained at predetermined spacing with the spacer set up between the anode plate substrate and the cathode substrate. And in this image display device, the spacer is formed in the abbreviation rectangle and predetermined tension is added in the direction of hauling of a longitudinal direction, i.e., the direction extended to a longitudinal direction. It seems for this reason, to produce neither distortion nor fracture in this image display device, even if a spacer is the case where heat treatment etc. is performed.

[0015] Moreover, the manufacture approach of the image display device concerning this invention which attained the purpose mentioned above The anode plate substrate with which it comes to form the image display section at least on the 1st substrate, and the cathode substrate with which it comes to form electron emission equipment at least on the 2nd substrate While facing manufacturing an image display device by making it counter through the spacer which presents an abbreviation rectangle and fixing the both ends of the longitudinal direction of the above-mentioned spacer to either [at least] the above-mentioned anode plate substrate or the above-mentioned cathode substrate It is characterized by adding

tension to the longitudinal direction of the spacer concerned.
[0016] The cathode substrate and the anode plate substrate are made to counter by arranging a spacer between an anode plate substrate and a cathode substrate by the manufacture approach of the image display device concerning this invention constituted as mentioned above. Moreover, by this technique, where predetermined tension is added in the direction which extends a spacer in the direction of hauling of that longitudinal direction, i.e., a longitudinal direction, it is fixing. For this reason, according to this technique, a spacer can be arranged, without distortion, fracture, etc. occurring.
[0017]
[Embodiment of the Invention] Hereafter, the gestalt of concrete operation of the image display device concerning this invention and its manufacture approach is explained to a detail, referring to a drawing.
[0018] The electron emission equipment shown in the gestalt of this operation is applied to a field-electron-emission mold display and the so-called FED (Field Emission Display), as typically shown in drawing 1 . This FED counters with the cathode substrate 2 with which the electron emission equipment 1 which performs field electron emission was formed in the shape of a matrix, and this cathode substrate 2, is arranged, and is equipped with the spacer 5 arranged between the anode plate substrate 4 with which the anode electrode 3 was formed in the shape of a stripe, and these cathode substrate 2 and the anode plate substrate 4. Moreover, in this FED, between the cathode substrate 2 and the anode plate substrates 4 has altitude with the vacua.
[0019] For this reason, in this FED, it will work in the direction in which the pressure by atmospheric air joins the cathode substrate 2 and the anode plate substrate 4. However, in this FED, it is maintaining so that the cathode substrate 2 and the anode plate substrate 4 may be made to counter at the predetermined spacing to the pressure mentioned above with the spacer 5 set up between the cathode substrate 2 and the anode plate substrate 4.
[0020] Moreover, in this FED, red fluorescent substance 6R which emits light in red is formed on the predetermined anode electrode 3, green emitter 6G which emit light in green are formed on the ****** anode electrode 3, and blue emitter 6B which emits light in blue on the ****** anode electrode 3 is further formed in the anode plate substrate 4. Namely, as for this anode plate substrate 4, red emitter 6R, green emitter 6G, and blue emitter 6B (hereafter, it collects and "a fluorescent substance 6" is only called.) are formed in the shape of a stripe by turns.
[0021] Furthermore, in this FED, two or more electron emission equipments 1 are arranged in the shape of a matrix by the cathode substrate 2. These electron emission equipment 1 is the so-called Spindt type of electron emission equipment, as shown in drawing 2 . The insulating substrates 7, such as glass, The cathode electrode 8 formed on this insulating substrate 7, and the emitter electrode 9 of approximate circle drill type formed on this cathode electrode 8, this emitter electrode 9 and predetermined spacing -- with, while being arranged, it consists of gate electrodes 11 by which the laminating was carried out to the cathode electrode 8 through the insulating layer 10. In this FED, while being formed in the shape of a stripe in parallel with the anode electrode 3 and fluorescent substance 6 which the cathode electrode 8 mentioned above, the gate electrode 11 is formed in the direction which intersects perpendicularly with this cathode electrode 8 in the shape of a stripe. And electron emission equipment 1 is formed in the field to which these cathode electrode 8 and the gate electrode 11 cross in this FED. Therefore, in this FED, electron emission equipment 1 will be formed in the shape of a matrix.
[0022] In case this electron emission equipment 1 is manufactured, plurality is drilled for the minute opening 12 which penetrates the gate electrode 11 and an insulating layer 10 in the crossover field formed in the shape of a matrix. That is, in case this electron emission equipment 1 is manufactured, two or more openings 12 to which the cathode electrode 8 is exposed are formed in a base. And the emitter electrode 9 of approximate circle drill type is formed by carrying out thin film formation of the discharge ingredient from across by technique, such as vacuum evaporationo, to this opening 12.
[0023] And in this FED, 1 pixel is formed from the electron emission equipment 1 arranged on the location which counters the fluorescent substance 6 of three colors, and the fluorescent substance 6 of these 3 color. In this FED, the pixel constituted in this way will be allotted in the shape of a matrix.
[0024] On the other hand, in this FED, a spacer 5 is formed in tabular [of an abbreviation rectangle],

and is set up between the anode plate substrate 4 and the cathode substrate 2. At this time, a spacer 5 is once attached in one side in the cathode substrate 2 and the anode plate substrate 4. Although this example shows the example which attached the spacer 5 in the cathode substrate 2, it is not limited to especially this and, of course, a spacer 5 may be attached in the anode plate substrate 4. Concretely, this spacer 5 is attached between the electron emission equipment 1 arranged in the shape of a matrix, as shown in drawing 3 . In other words, this spacer 5 will be arranged in between the pixels constituted as mentioned above (i.e., an invalid pixel field). As for a spacer 5, in this FED, it is desirable that two or more are equally formed in the field of a screen.

[0025] And as shown in drawing 4 and drawing 5 , this spacer 5 is being fixed when near the both ends of that longitudinal direction pastes the cathode substrate 2 through adhesives. At this time, as the drawing 4 Nakaya mark a shows to a spacer 5, the predetermined tension is added in the direction of hauling of that longitudinal direction. In addition, as shown in this drawing 4 and drawing 5 , the cathode substrate 2 and the anode plate substrate 4 are maintaining predetermined spacing through a peripheral wall 18. This peripheral wall 18 serves as the shape of the periphery of the cathode substrate 2 and the anode plate substrate 4, and abbreviation isomorphism, and is joined through frit glass 19 to the cathode substrate 2 and the anode plate substrate 4. For this reason, in this FED, the internal air leak is prevented with the cathode substrate 2, the anode plate substrate 4, a peripheral wall 18, and frit glass 19.

[0026] Moreover, in this FED, in order to maintain an internal degree of vacuum to a predetermined value, the exhaust pipe 20 furnished with evacuation equipment (not shown) is formed. Moreover, the gas adsorption material 21 is arranged in this exhaust pipe 20. For this reason, in this FED, the evacuation equipment which is not illustrated is attached through an exhaust pipe 20, and let the building envelope which consists of a cathode substrate, an anode plate substrate, and a peripheral wall 18 be a vacua. And after the gas adsorption material 21 is made into a vacua, it adsorbs the gas constituents which remain in a building envelope, and is maintaining the degree of vacuum in a building envelope to altitude.

[0027] On the other hand, in case such a spacer 5 is set up to the cathode substrate 2, temperature of a spacer 5 is made high as compared with the temperature of the cathode substrate 2, and it fixes to the cathode substrate 2 at the both ends of the longitudinal direction of a spacer 5. In other words, by making temperature of a spacer 5 high as compared with the temperature of the cathode substrate 2, a spacer 5 is fixed to the cathode substrate 2, where thermal expansion is carried out. And when the temperature of a spacer 5 and the temperature of the cathode substrate 2 become a **** EQC after fixing, a spacer 5 will contract, and it will be fixed to the cathode substrate 2 where tension is applied in the direction of hauling of a longitudinal direction.

[0028] Specifically, a spacer 5 is fixed on the cathode substrate 2 using the jig 25 as shown in drawing 6 . This jig 25 consists of ingredients with metaled high thermal conductivity, and it comes to form the slot 26 for inserting in a spacer 5, and it is considered as a configuration which has the heater 27 for heating the spacer 5 with which this slot 26 was inserted in and loaded.

[0029] At this time, first, as shown in drawing 6 , where a spacer 5 is inserted in a slot 26, this jig 25 is heated at a heater 27. By this, a spacer 5 will be heated by desired temperature. Concretely, as for a jig 25, it is desirable to be heated so that the temperature of the spacer 5 to insert in may become higher about 10-100 degrees C than the temperature of the cathode substrate 2. At this time, when heated by predetermined temperature, thermal expansion of the spacer 5 is carried out.

[0030] Next, the cathode substrate 2 and spacer 5 which adhered to adhesives 28 are correctly positioned to a position, and are made to contact it, where a spacer 5 is maintained to predetermined temperature as shown in drawing 7 . In other words, a spacer 5 is fixed on the cathode substrate 2, where thermal expansion is carried out. At this time, it is desirable as adhesives 28 to use ultraviolet curing mold adhesives. After contacting the cathode substrate 2 and a spacer 5 as mentioned above when ultraviolet curing mold adhesives are used, adhesives 28 can be easily solidified by irradiating ultraviolet rays. For this reason, when the ultraviolet-rays effectiveness mold adhesives are used, adhesion with the cathode substrate 2 and a spacer 5 can be performed easily.

[0031] Next, as shown in drawing 8 , after removing a spacer 5 from a jig 25, a protective coat 29 is formed so that the adhesives 28 mentioned above may be covered. As this protective coat 29, heat-resistant inorganic adhesive can be used preferably. Thus, even when the adhesives 28 mentioned above by covering the adhesives 28 which looked like [the protective coat 29] and were mentioned more above lose an adhesive property by subsequent heat treatment, it becomes possible to certainly fix a spacer 5 to the cathode substrate 2.
[0032] Moreover, in case a spacer 5 and the cathode substrate 2 are pasted up, as shown in drawing 9 , only the inorganic system adhesives 30 may be used. In this case, it is desirable that it is what hardens by the exposure of laser etc. for a short time, and can be certainly pasted up with a spacer 5 and the cathode substrate 2 as inorganic system adhesives 30. Such inorganic system adhesives 30 can paste up a spacer 5 and the cathode substrate 2 certainly so that an adhesive property may not be lost by subsequent heat treatment.
[0033] thus, the thing a spacer 5 is fixed [a thing] to the cathode substrate 2 for the temperature of a spacer 5 in the condition higher than the temperature of the cathode substrate 2 -- a spacer 5 and the cathode substrate 2 -- **** -- when it becomes the same temperature, predetermined tension can be added in the direction of hauling of the longitudinal direction of a spacer 5. That is, according to the technique mentioned above, where tension which extends a spacer 5 to a longitudinal direction is added, a spacer 5 is fixable to the cathode substrate 2.
[0034] And although not illustrated, the field of a request of two or more spacers 5 can be made to set up two or more spacers 5 by carrying out sequential immobilization to the cathode substrate 2 similarly.
[0035] Moreover, in case a spacer 5 is set up to the cathode substrate 2, a spacer 5 may be fixed, where it was not limited to the technique mentioned above, for example, the cathode substrate 2 is cooled. In other words, by cooling the cathode substrate 2, where the cathode substrate 2 is shrunk, a spacer 5 is fixed. And when the temperature of the cathode substrate 2 and the temperature of a spacer 5 serve as a **** EQC after fixing, the cathode substrate 2 will carry out thermal expansion, and tension which was mentioned above to the longitudinal direction of a spacer will be applied.
[0036] Thus, in constituted FED, between the cathode substrate 2 and the anode plate substrates 4 is maintained at predetermined spacing by arranging the tabular spacer 5 to the big pressure produced by atmospheric air. For this reason, in this FED, even when the cathode substrate 2 and the anode plate substrate 4 are formed using the thin-shape-ized glass substrate, it is prevented certainly that the pressure mentioned above breaks. In other words, by FED mentioned above, since a thin glass substrate can be used, as compared with the conventional thing, it can thin-shape-ize more.
[0037] Moreover, by adding tension to the longitudinal direction, a spacer 5 is arranged so that it may not be distorted. For this reason, this spacer 5 becomes what was excellent in location precision as a whole as did not cover and hang on electron emission equipment 1 by raising the positioning accuracy near [which is fixed to the cathode substrate 2] both ends. Therefore, in this FED, the brightness of a display image can be maintained good so that a spacer 5 cannot be exposed to an effective pixel field.
[0038] Concretely, coefficient-of-thermal-expansion alphas heats the spacer 5 which consists of a zirconia (Young's modulus =210GPa) which is 100x10-7 at 60 degrees C, and presupposes that it fixes on the 20-degree C cathode substrate 2. At this time, elongation-percentage beta of a spacer 5 is called for as x (100x10-7) (60-20) from beta=alpha sx**t (**t is temperature variation). Moreover, the tension stress added to the spacer 5 fixed on the cathode substrate 2 is set to 8.4x107 (Pa) from Hooke's law T=Eepsilon (E: Young's modulus, epsilon:elongation percentage). The tension of 8.4x107 (Pa) is added and location gap seems thus, not to produce the spacer 5 which consists of a zirconia.
[0039] By the way, a heat treatment process may be performed in FED which was mentioned above. Generally, if the coefficient of thermal expansion of a spacer 5 differs from the coefficient of thermal expansion of the cathode substrate 2, a possibility that a spacer 5 may be distorted in a heat treatment process, or a spacer 5 may fracture will arise by performing a heat treatment process. That is, if the thermal expansion or contraction from which a spacer 5 and the cathode substrate 2 differ in a predetermined temperature change is generally caused, based on the difference between this thermal expansion or contraction, a possibility that a spacer 5 may be distorted or a spacer 5 may fracture will

arise.
[0040] Moreover, a cooling test may be performed in FED which was mentioned above. That is, FED may be set as the temperature below the so-called security temperature, and characterization etc. may be performed. Also in such a cooling test etc., if the coefficient of thermal expansion of a spacer 5 differs from the coefficient of thermal expansion of the cathode substrate 2, a possibility that a spacer 5 may be distorted during a cooling test, or a spacer 5 may fracture will arise by performing a cooling test.
[0041] Then, distortion and fracture of a spacer 5 are certainly prevented by controlling whenever [after spacer 5 set-up / temperature / at the time of setting up the coefficient of thermal expansion of a spacer 5 and the coefficient of thermal expansion of the cathode substrate 2, and a spacer 5 /, and stoving temperature], and, the cooling temperature after spacer 5 set-up by FED mentioned above to fulfill predetermined conditions.
[0042] The coefficient of thermal expansion of alphas and the cathode substrate 2 is specifically set to alphag for the coefficient of thermal expansion of a spacer 5. (A spacer 5) Set t1 and ** (stoving temperature [after spacer 5 set-up] whenever) - (temperature of the cathode substrate 2 at the time of spacer 5 set-up) to t2, and ** (cooling temperature after spacer 5 set-up) - (temperature of the cathode substrate 2 at the time of spacer 5 set-up) is set to **t1 for temperature - at the time of setting up (temperature of the cathode substrate 2 at the time of spacer 5 set-up). When the maximum elongation percentage within the tensile strength limit of a spacer 5 is set to epsilon, in alpha s<=alpha g, it is alphasx**t1+(alphag-alphas) x**t2<epsilon... (1)
alphasx**t1-(alphag-alphas) x**t3> 0 ... (2)
The becoming formula is filled and, in alpha s>=alpha g, it is alphasx**t1+(alphag-alphas) x**t2>0... (3)
alphasx**t1-(alphag-alphas) x**t3<epsilon ... (4)
It is desirable to fill the becoming formula.
[0043] When the coefficient of thermal expansion of a spacer 5 is below a coefficient of thermal expansion of the cathode substrate 2 at this time, the tension of the direction of hauling will be added to the spacer 5 which the cathode substrate 2 expanded more, and the spacer 5 contracted relatively, consequently was fixed to the cathode substrate 2 by being heated (when it being alphas<=alphag). Moreover, the tension of the contraction direction is added to the spacer 5 which the cathode substrate contracted more, and the spacer 5 expanded relatively, consequently was fixed to the cathode substrate by being cooled in this case.
[0044] On the other hand, when the coefficient of thermal expansion of a spacer 5 is more than a coefficient of thermal expansion of the cathode substrate 2, the tension of the direction to contract will be added to the spacer 5 which the spacer 5 expanded more, and the cathode substrate 2 contracted relatively, consequently was fixed to the cathode substrate 2 by being heated (when it being alphas>=alphag). Moreover, the tension of the direction of hauling will be added to the spacer 5 which the spacer 5 contracted more, and the cathode substrate 2 expanded relatively, consequently was fixed to the cathode substrate 2 by being cooled in this case.
[0045] It sets here at the above-mentioned (1) formula, (2) types, (3) types, and (4) ceremony. alphasx**t1 The tension produced in the spacer 5 when a spacer 5 was fixed is shown. x(alphag-alphas) **t2 The amount of telescopic motion which originated in the difference in the coefficient of thermal expansion of a spacer 5 and the cathode substrate 2, and was produced in the spacer 5 at the time of heating is shown, and x(alphag-alphas) **t3 show the amount of telescopic motion which originated in the difference in the coefficient of thermal expansion of a spacer 5 and the cathode substrate 2, and was produced in the spacer 5 at the time of cooling. For this reason, (1) type has prescribed that the sum total of the tension of the direction of hauling added to a spacer 5 at the time of heating does not exceed maximum elongation-percentage epsilon within the tensile strength limit of a spacer 5. Therefore, what a spacer 5 fractures at the time of heating is certainly prevented by filling this (1) type.
[0046] Moreover, by (2) formulas, since the tension of the contraction direction added to a spacer 5 at the time of cooling is added, it has specified not exceeding the tension produced at the time of spacer 5 immobilization. Therefore, it is certainly prevented by filling this (2) type that a spacer 5 is distorted at

the time of cooling.

[0047] Furthermore, by (3) formulas, since the tension of the contraction direction added to a spacer 5 at the time of heating is added, it has specified not exceeding the tension produced at the time of spacer 5 immobilization. Therefore, what is distorted at the time of heating is certainly prevented by filling (3) types.

[0048] (4) types have prescribed that the sum total of the tension of the direction of hauling added to a spacer 5 at the time of cooling does not exceed maximum elongation-percentage epsilon within the tensile strength limit of a spacer 5 further again. Therefore, what a spacer 5 fractures at the time of cooling is certainly prevented by filling this (4) type.

[0049] On the other hand, when a spacer is fixed on a cathode substrate in the condition of not adding predetermined tension, a big distortion and fracture will arise. as a spacer -- a coefficient of thermal expansion -- the coefficient of thermal expansion of a cathode substrate -- comparing -- 5x10-7/degree C -- it is small, and when it heats even at 450 degrees C after immobilization using a tabular spacer with a width of face [of 50 micrometers], and a die length of 100mm, as shown in drawing 10 , 1mm [a maximum of] distortion will arise at the time of heating. When it carries out after making the cathode substrate and anode plate substrate which fixed the spacer for this heat-treatment counter concretely, it projects from spacing of the electron emission equipment with which a tabular spacer adjoins, and there is a possibility of doing fatal damage to the fluorescent substance arranged on the anode plate substrate. In such a case, FED will display an image with a defect.

[0050] However, in FED shown in the gestalt of this operation mentioned above, as mentioned above, what produces distortion and fracture even if a heat treatment process, a cooling test, etc. are performed by performing conditioning is prevented so that (1) type, (2) types, (3) types, and (4) types may be filled, and a spacer 5 can maintain the condition that desired tension was always added. By this, this spacer 5 will be arranged with a higher location precision, even when a heat treatment process, a cooling test, etc. are performed. It seems that therefore, the fluorescent substance 6 arranged on the anode plate substrate 4 is not damaged in this FED, for example. For this reason, this FED can display a good image certainly, without it seeming that brightness falls.

[0051]

[Effect of the Invention] As mentioned above, the image display device applied to this invention as explained to the detail is fixing the both ends of a spacer to either [at least] the above-mentioned anode plate substrate or the above-mentioned cathode substrate, where tension is added to the longitudinal direction of a spacer. For this reason, a spacer will be arranged in a desired location in this image display device, without producing distortion and fracture in a spacer. Therefore, this image display device has the reinforcement which was excellent to the big pressure, without reducing the brightness of a display image.

[0052] Moreover, the manufacture approach of the image display device concerning this invention is in the condition which added predetermined tension to the longitudinal direction, and has attached the spacer. For this reason, according to this technique, a spacer can be certainly attached in a high location precision so that neither distortion nor fracture may arise.

[Translation done.]